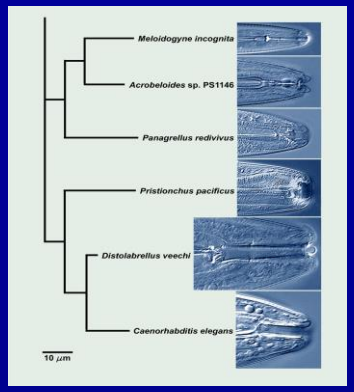
Nematode Taxonomy at USDA-ARS Mycology & Nematology Genetic Diversity & Biology Lab July 2019

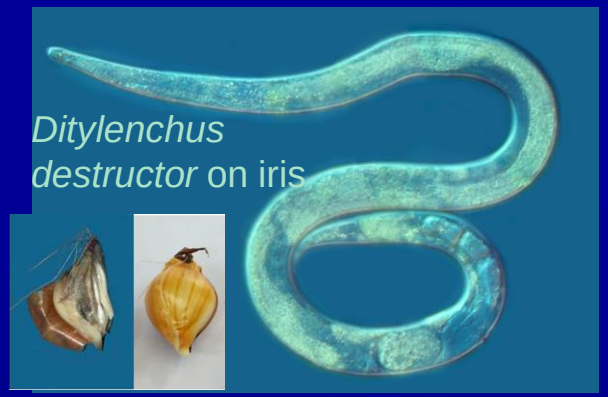
Lynn Carta

MNGDBL Nematology Project

Globodera pallida

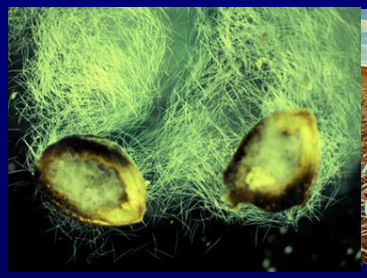

Idaho potato




Ditylenchus destructor on iris

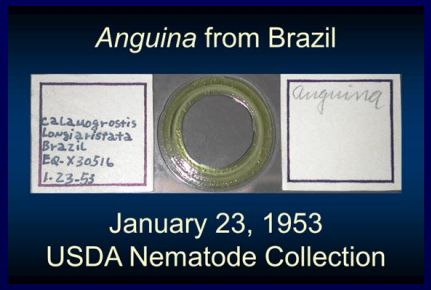
Update and improve classification of plant-parasitic nematodes and introduce new taxonomic techniques and characters into nematode systematics.

Provide expert nematode identifications and curatorial services involving the USDA Nematode Collection, as urgently required by ARS scientists, federal and state researchers, and regulatory agencies.




Anguina tritici on wheat

Describe new species compile keys
List nematode host associations
Maintain nematode collections
Determine new traits for identification
Place traits in family trees for biological predictions
Characterize nematodes from soil and insects



USDA Nematode Collection: The world's largest (35K entries) resource for nematode identification.

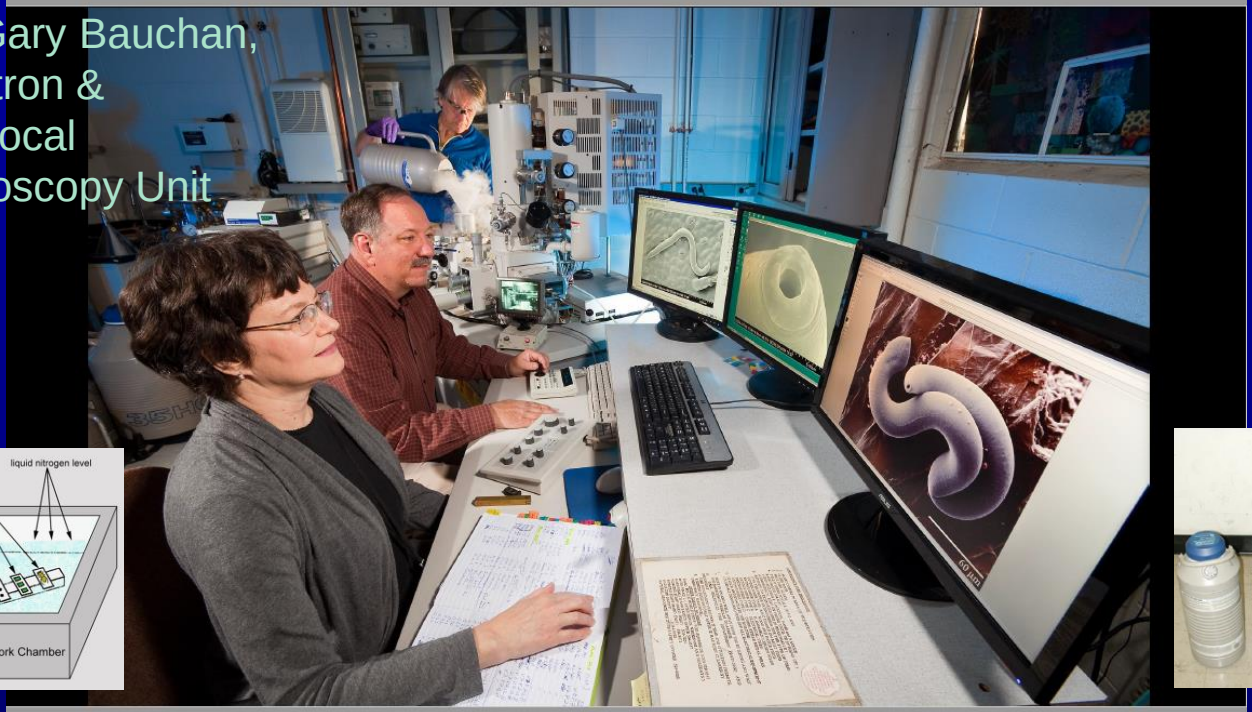
Fireproof safes house the collection

Specimens on slides in the collection

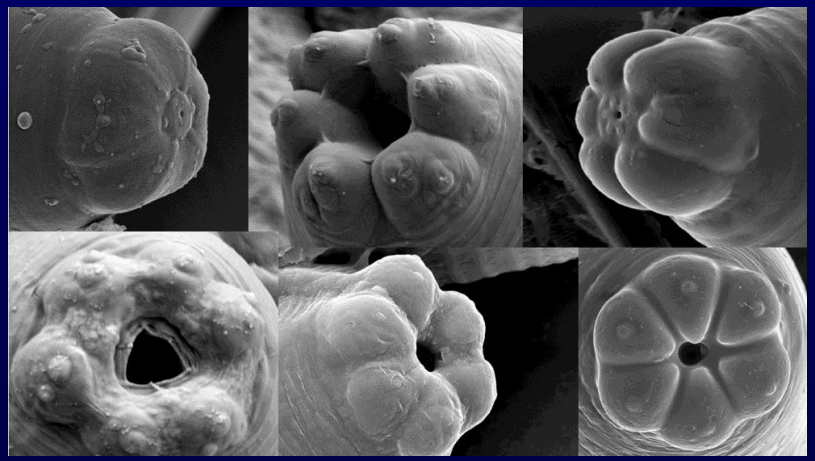
Curated by Dr. Zafar Handoo

Low Temperature Scanning Electron Microscopy

Dr. Gary Bauchan,
Electron &
Confocal
Microscopy Unit

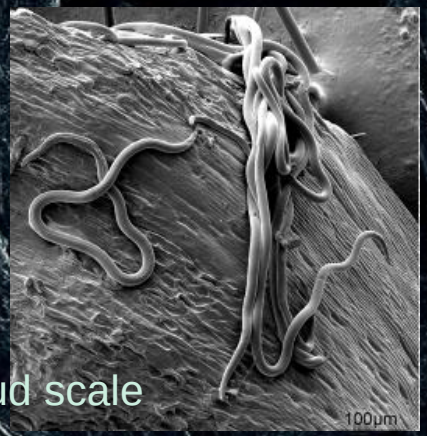


Hitachi S-4100 field emission Scanning Electron Microscope

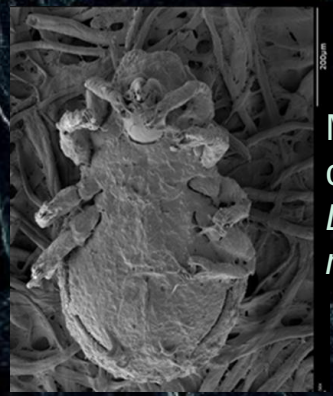


Nematode from Beech Leaf Disease
Lake County, OH near Lake Erie

Nematode face



Nematodes on bud scale



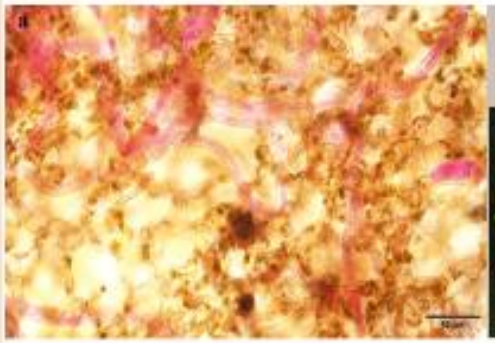
Mite from leaf consuming *L. crenatae mccannii*

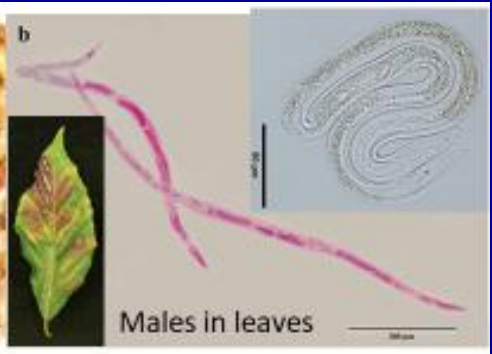
50 µm

Litylenchus crenatae mccannii ssp. n.

Beech leaf disease symptoms caused by new subspecies *Litylenchus crenatae mccannii* (Anguinata) described from *Fagus grandifolia* (Fagaceae) in North America

American beech seedlings with symptoms after bud, but not leaf, inoculations with nematodes in water from symptomatic leaves.





a) Acid Fuchsin Stain of symptomatic leaf strip at RT for 21 days,
b) nematodes confirmed from leaves of inoculated seedlings

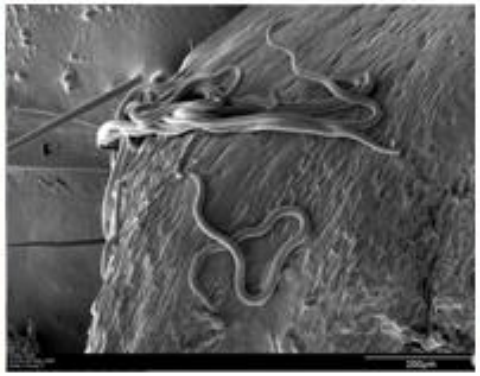
Beech Leaf Disease
Litylenchus crenatae

Females and eggs from buds

Strips of symptomatic beech leaves that produced 10,000 nematodes in 2 hours

Nematodes entered fresh leaves in agar plates, did not develop. They did not grow on *Rhizoctonia* fungi.

Litylenchus adults inoculated to beech bud tip in water agar plate. Dissection demonstrated that nematodes entered the bud but did not develop



Carta, L. K. Handoo, Z. A., Li, S., Kantor, M., Bauchan, G., McCann, D., Gabriel, C. K., **Yu, Q., Reed, S.,** Koch, J., Martin, D., & Burke, D. J.

Manuscript Submitted to *Forest Pathology*

Two nematophagous *Pleurotus* mushroom species differentially consume some of thirteen bacterial-feeding nematode species but are themselves consumed by others

Forests 10: 404. DOI:/10.3390/f10050404

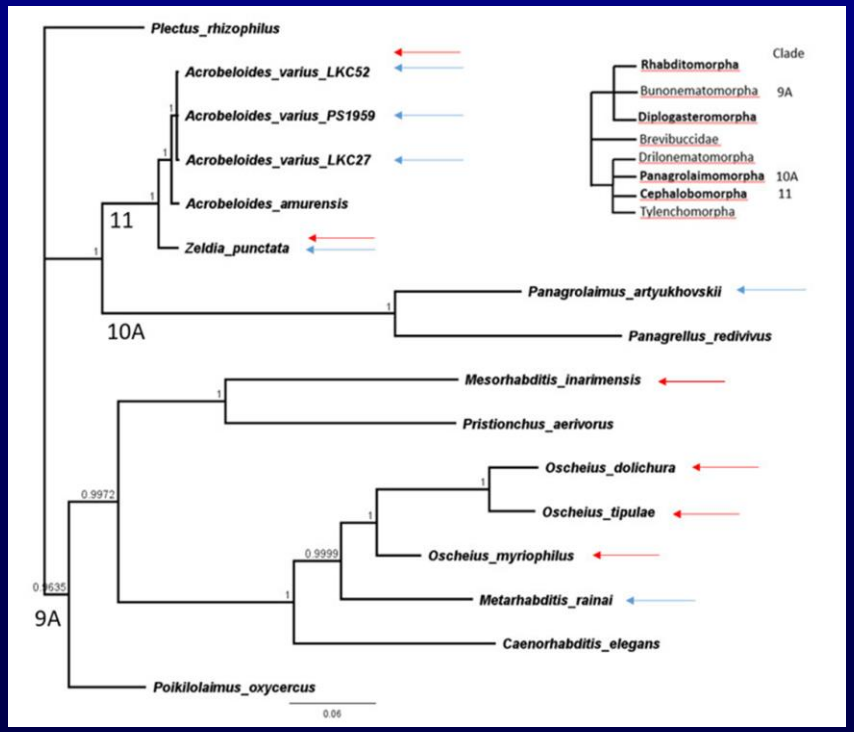
M. Marlin, A. Wolf, M. Alomran, L. Carta & G. Newcombe

Oyster mushrooms paralyze and consume nematodes, but does that means all nematodes and mushroom species? Two toxin-producing *Pleurotus pulmonarius* and *Pleurotus ostreatus* were tested with 13 nematode species on water agar until they consumed and reproduced, or died from toxin and were consumed. Nine were susceptible to *P. pulmonarius* (all were paralyzed) but four (four populations of two cephalobid species, one rhabditid, and one panagrolaimid survived exposure to *P. pulmonarius*. The resistant four species not only survived but multiplied by consuming *P. pulmonarius*. A similar trend was observed with nematodes interacting with *P. ostreatus*; but six species were resistant to *P. ostreatus*. Surprisingly, four of these six species were susceptible to *P. pulmonarius*, and interactions overall were differential. *Pleurotus* species are nematophagous toward some nematodes but are also consumed by others in three of the four families assayed. Species-specific interactions should encourage studies of the host ranges of both "nematophagous" fungi and "fungivorous" nematodes, especially if they are to be used for biological control.

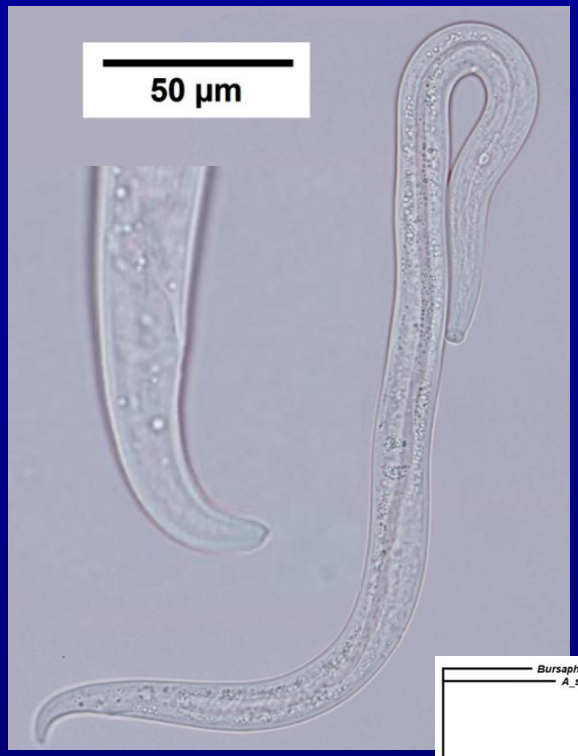
Species	Culture Isolate	GenBank Accession/Isolate	Clade in van Megen et al., 2009 [23]
Oscheius dolichura	LKC50	KP756940 JU72	9A Rhabditomorpha
Oscheius myriophilus	DF5020	U81588	9A
Oscheius tipulae	LKC57	CEW1 KP756939	9A
Caenorhabditis elegans	N2	NR000054	9A
Mesorhabditis inarimensis	LKC51	90A3 * MK636575	9A
Poikilolaimus oxycercus	LKC64	101A3* MK636576	9A
Metarhabditis rainai	LKC20	AF083008 PS1191	9A
Pristionchus aerivorus	LKC54	90C1 * MK636577	9A Diplogasteromorpha
Panagrolaimus artyukhovskii	LKC44	90E9 * MK636578	10A Panagrolaimomorpha
Panagrellus redivivus	PS1163	AF083007	10A
Zeldia punctata	PS1192	U61760	11 Cephalobomorpha
Acrobeloides amurensis	PS1146	AF034391	11
Acrobeloides varius **	LKC27	94A6 * MK636581	11
Acrobeloides varius	LKC52	100H3 * MK636579	11
Acrobeloides varius **	PS1959	104M16 * MK636580	11
Plectus rhizophilus	PlecRhi1	AY593928	6 (Outgroup)

Pleurotus pulmonarius spring
Pleurotus ostreatus, fall-winter

Figure 2. (a) Susceptible (*Poikilolaimus oxycercus*) consumed by *Pleurotus ostreatus* hyphae. (b) Resistant *Zeldia punctata*, near *Pleurotus ostreatus* hyphae. Reproductive ability evidenced by eggs.



Blue and red arrows indicate taxa resistant to *P. pulmonarius* and *P. ostreatus*, respectively.



Ongoing work

Foliar Nematodes of Strawberries. Koch's postulates not tested with *Aphelenchoides bicaudatus,* also reported in sick strawberries in Taiwan

Conflicting molecular markers and nematode morphology in foliar nematodes of fruit trees and strawberries

Sick strawberries from a fruit lab breeder, Janet Slovin. A specimen from this pot did not have the typical tail bifurcation of *A. fragariae*, the most common ornamental leaf pathogen of strawberry. Are other isolates available?